

CLAIMS

What is claimed is:

1. A fault tolerant graphics controller comprising:
 - 5 an error code generator that receives graphics command codes, the error code generator configured to generate an error code for each graphics command code received;
a frame buffer for storing graphics data and graphics commands, including the error codes generated by the error code generator;
an error code decoder connected between the frame buffer and the graphics controller
10 and configured to determine from a command code and its associated error code whether or not there is an error in the command code and to provide an indication thereof; and
a graphics controller for executing the graphics command codes to display the graphics data.
- 15 2. A fault tolerant graphics controller as recited in claim 1, wherein the error code generator is a software module that is configured to store the received graphics commands into an array and to compute for each command a portion of an error code, such that, after a given number of commands is received, a check code for the given number of commands and the commands are available for processing by a CPU.
- 20 3. A fault tolerant graphics controller as recited in claim 2, wherein the given number of commands is eight and the check code has a size in bits and the commands have a size in bits that are equal.
- 25 4. A fault tolerant graphics controller as recited in claim 1,
 - wherein the error code generator receives data associated with graphics commands and is further configured to generate an error code for graphics data received; and
wherein the error code decoder is configured to determine from graphics data and its associated error code whether or not there is an error in the graphics data and to provide an
30 indication thereof.
5. A fault tolerant graphics controller as recited in claim 1, wherein the error code generator is configured to generate error codes, each 32 bits, for a group of eight graphics command

codes, each 256 bits, and to combine the eight error codes together into a single 256 bit unit, for storage in the frame buffer along with the eight command codes.

5 6. A fault tolerant graphics controller as recited in claim 5, wherein the eight command codes and the combined eight error codes form a group of nine units of information, each 256 bits, to be stored as a unit in the frame buffer.

10 7. A fault tolerant graphics controller as recited in claim 6, wherein read and write pointers are included within the combined error code to provide demarcation of the individual error codes therein.

15 8. A fault tolerant graphics controller as recited in claim 1, wherein the error code decoder is configured to determine that a detected error in the command code is correctable and the decoder is further configured to correct the error in the command code.

9. A fault tolerant graphics controller as recited in claim 1, further comprising an interrupt and status controller, connected to the error code decoder, the interrupt and status controller configured to generate an interrupt or error status to a computer system hosting the graphics controller in response to the error indication from the error code decoder.

20 10. A fault tolerant graphics controller as recited in claim 1,
wherein the error indication from the error code decoder indicates that the error is uncorrectable; and
further comprising an interrupt and status controller connected to the error code
25 decoder, the interrupt and status controller configured to generate an interrupt or error status to a computer hosting the graphics controller in response to the error indication when said indication indicates the error is uncorrectable.

30 11. A fault tolerant graphics controller as recited in claim 1, further comprising a flush-command controller connected to the error code decoder, the flush-command controller configured to flush command codes with errors from the graphics controller in response to the error indication.

12. A fault tolerant graphics controller as recited in claim 11, wherein the flush-command controller is configured to flush data associated with any erroneous command that is flushed.
13. A fault tolerant graphics controller as recited in claim 1,
5 wherein the error indication from the error code decoder indicates that the error is uncorrectable; and
 further comprising a flush-command controller connected to the error code decoder, the flush-command controller configured to flush command codes with errors from the graphics controller in response to the error indication when said indication indicates the error
10 is uncorrectable.
14. A fault tolerant graphics controller as recited in claim 13, wherein the flush-command controller is configured to flush data associated with any erroneous command that is flushed.
- 15 15. A fault tolerant graphics controller as recited in claim 1, further comprising a store-command controller connected to the error code decoder, the store-command controller configured to store command codes before and after the command code determined to have an error in response to the error indication.
- 20 16. A fault tolerant graphics controller as recited in claim 1,
 wherein the error indication from the error code decoder indicates that the error is uncorrectable; and
 further comprising a store-command controller connected to the error code decoder, the store-command controller configured to store command codes before and after the
25 command code determined to have an error in response to the error indication when said indication indicates that the error is uncorrectable.
17. A method for processing graphics commands, comprising:
 receiving a graphics command code;
30 generating an error code for the graphics command code;
 storing the graphics command code and its associated error code in a frame buffer configured to store graphics command codes and graphics data;

accessing the frame buffer for the graphics command code and obtaining its associated error code;

determining from the graphics command code and its associated error code whether there is an error in the graphics command code and providing an indication thereof;

5 executing the graphics commands to display the graphics data.

18. A method for processing graphics commands, as recited in claim 17, further comprising:

receiving graphics data;

generating an error code for graphics data;

10 storing the graphics data in the frame buffer;

accessing the frame buffer for the graphics data and obtaining its associated error code; and

determining from the graphics data and its associated error code whether there is an error in the graphics data and providing an indication thereof.

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19. A method for processing graphics commands, as recited in claim 17, further comprising generating an interrupt or error status in response to an error indication.

20. A method for processing graphics commands, as recited in claim 17, further comprising generating an interrupt or error status in response to an error indication when said indication indicates that the error is uncorrectable.

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21. A method for processing graphics commands, as recited in claim 17, further comprising preventing the execution of command codes in response to an error indication.

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22. A method for processing graphics commands, as recited in claim 17, further comprising preventing the execution of command codes in response to an error indication when said indication indicates that the error is uncorrectable.

30 23. A method for processing graphics commands, as recited in claim 17, further comprising storing commands before and after a command having an erroneous code in response to an error indication.

24. A method for processing graphics commands, as recited in claim 17, further comprising storing commands before and after a command having an erroneous code in response to an error indication when said indication indicates that the error is uncorrectable.

5 25. A method for processing graphics commands, as recited in claim 17,
 wherein a group of graphics command codes is received;
 wherein generating an error code for the graphics command code includes generating
an error code for each command code in the group; and
 further comprising combining the error codes together into a single code word having
10 the same size as any of the graphics command codes.

26. A method for processing graphics commands, as recited in claim 25,
 wherein the group includes eight graphics command codes, each 256 bits; and
 wherein each error code is 32 bits and the combined error code is 256 bits.

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